

Original Research

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Sociodemographic and Psychological Predictors of Resilience Among Frontline Nurses Fighting the COVID-19 Pandemic

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Abstract

Objective: According to a WHO report, the number of patients with coronavirus disease 2019 (COVID-19) has reached 456,797,217 worldwide as of 15 March, 2022. In Wuhan, China, large teams of health-care personnel were dispatched to respond to the COVID-19 emergency. This study aimed to determine the sociodemographic and psychological predictors of resilience among frontline nurses fighting the current pandemic.

Methods: A total of 143 nurses were recruited from February 15 to February 20, 2020, to participate in this study. The 10-item Connor-Davidson Resilience Scale and the 21-item Depression Anxiety Stress Scale were used to estimate the participants' resilience and mental wellbeing.

Results: Results showed that the nurses displayed a moderate resilience level. Their median depression, anxiety, and stress scores were 1, 2, and 3, respectively, which were negatively correlated with resilience. Female gender, being dispatched to Wuhan, and depression levels were the significant predictors of resilience.

Conclusions: The results suggest that particular attention should be given to nurses who were dispatched to Wuhan and who exhibited depression symptoms, and appropriate measures should be taken to boost their resilience.

The coronavirus disease 2019 (COVID-19) has become a global public health emergency, and it has caused huge losses to the economy and has resulted in the loss of human lives and properties.¹ According to a World Health Organization (WHO) report, as of March 15, 2022, the number of COVID-19 cases has reached 456,797,217 in more than 220 countries across regions.² Medical staff play a vital role in the prevention and control of the COVID-19 pandemic. To fight against the COVID-19 infection, 42,600 medical personnel were dispatched to Hubei province in China since January 24, 2020; of them, 28,600 or nearly 70% were nurses.³

It has been established that public health emergencies can easily cause great psychological crisis to both the medical staff and the general public. During the severe acute respiratory syndrome (SARS) outbreak in Singapore in 2003, 27% of the health-care workers exhibited psychiatric symptoms,⁴ whereas significant rates of SARS-related psychiatric (22.9%) and posttraumatic morbidities (25.8%) were observed among noninfected community individuals.⁵ Similarly, health-care personnel who managed patients with Middle East respiratory syndrome-coronavirus (MERS-CoV) in Saudi Arabia in 2014 experienced fear and nervousness.⁶ In China, more than half of the general public rated the psychological impact of the COVID-19 outbreak as moderate to severe, and approximately one-third have experienced moderate to severe anxiety during the initial phase of the COVID-19 outbreak.⁷ This finding suggests that psychological problems may occur because of the high infection risk and because of the unknown nature of COVID-19, especially in the early stages of the outbreak. Health-care workers managing COVID-19 patients are at a high risk of getting infected, and they bear a heavy burden in the clinical treatment and in the public prevention efforts in Chinese hospitals⁸; the different challenges and levels of stress they have experienced can lead to serious psychological disorders, such as anxiety and depressive disorders as well as posttraumatic stress disorder (PTSD).⁹ Nurses constitute the majority of the medical staff dispatched to Wuhan. Therefore, a timely analysis of the mental health status of these frontline anti-epidemic nurses is urgently needed so that both public and nursing administrators could provide targeted psychological interventions.

As a positive mental attribute, resilience helps individuals to rebound after experiencing negative events, especially major traumas, dilemmas, setbacks, difficulties, and stressful or even life-threatening situations.¹⁰ It plays a key role in the response to stressful events and in the adaptation to environmental changes through one's adoption of effective coping strategies.¹¹ Individuals with higher resilience levels display such positive psychological attributes as optimism and humor, which help them manage hardships and unpleasant emotions with appropriate solutions. Studies have shown that nurses with adequate resilience may display greater adaptive capacity and better control of personal emotions, and they demonstrate lower likelihood of exhibiting such negative emotions as anxiety and irritability.¹² Using a randomized controlled trial, Mealer *et al.* found that the intensive care unit (ICU) nurses who underwent a resilience training displayed a reduced level of PTSD.¹³ Moreover, resilience was reported to play a protective role against nursing turnover and burnout.^{14,15} Resilience has also been linked to nursing qualities and job satisfaction.^{16,17} Thus, evaluating the resilience of frontline anti-epidemic nurses and identifying its influencing factors are of vital importance in alleviating career burnout, in safeguarding nursing qualities, and in promoting mental wellbeing.

The influence of demographic and psychological factors on resilience among nurses has already been examined. Inconsistencies were observed in the association between demographic factors and nurses' resilience.¹⁸ Rodriguez-Llanes *et al.* and Ang *et al.* found that age and gender are correlated with resilience, wherein female and young nurses exhibit lower resilience than male and older nurses.^{19,20} Guo *et al.* investigated 1,061 Chinese nurses and found that education, regular exercise, and being a nonsmoker are predictors of a high level of resilience ($P < 0.01$).²¹ By contrast, Gillespie *et al.* found no significant correlation between resilience and educational level.²² According to a survey involving 1338 Singaporean nurses, marriage is a protective factor of resilience.²⁰ A possible explanation for this finding lies in the fact that marriage could broaden individuals' social circles, providing them access to more support whenever they face stressful events.

Regarding psychological factors (such as anxiety or depression), it was reported that even if anxiety is an adaptive emotional response to stress and may play an initial protective role,²³ long-term anxiety can adversely affect physical and mental health, and people with mental health problems display a reduced ability to cope with stress.²⁴ A survey involving 1743 nurses in Australia showed that depression, anxiety, and stress are negatively correlated with resilience levels,²⁵ consistent with the findings of pediatric health-care professionals in 2011.²⁶ Similarly, by investigating 744 ICU nurses in the United States, Mealer *et al.* found that a high resilience level was significantly associated with symptoms of anxiety or depression and with a reduced prevalence of PTSD.²⁷ Also, Saksvik-Lehouillier *et al.* found that anxiety ($r = -0.38$; $P < 0.01$) and depression ($r = -0.44$; $P < 0.01$) were negatively correlated with resilience among Norwegian nurses employed in shift work arrangements, which include night shifts.²⁸

COVID-19 is a novel infectious disease that we know very little about it; to reduce the effects of stressful events related to the current pandemic and to maintain the mental health of medical staff, the resilience of individuals may be boosted with interventions.²⁹ Currently, there is no known information about the resilience of frontline anti-epidemic nurses, so we examined their resilience levels, as well as the demographic and psychological predictors of

resilience. This study may serve as a reference in formulating intervention schemes aimed at improving nurses' resilience.

Methods

Study Design

A descriptive cross-sectional design was used in a survey study conducted from February 15 to February 20, 2020.

This study was conducted in strict accordance with the provisions of the Declaration of Helsinki. The study protocol was approved by our institutional Ethics Committee (Institutional Review Board Approval Number: 202002005). All nurses who met the inclusion criteria received a questionnaire and were informed that their participation was voluntary. The questionnaires were anonymous, and a description of how confidentiality would be ensured was provided.

Study Population and Sample

A convenience sampling method was used in this study. The recruited nurses came from Xiangya Hospital of Central South University in Changsha city who worked in fever clinic, infection department, emergency department, or ICU. During the outbreak of COVID-19, 100 nurses from the Xiangya Hospital of Central South University were deployed to manage COVID-19 at the Xiangya ward (50 beds) set in the West Campus of Union Hospital Tongji Medical College of Huazhong University of Science and Technology in Wuhan, it is a tertiary hospital with 1200 beds and 810 beds were allocated for ordinary, severe and critical COVID-19 patients. Meanwhile, the Xiangya hospital of Central South University offered up to 100 beds for COVID-19 cases. So, the participants in this study were frontline nurses serving in the Xiangya Hospital of Central South University and those being dispatched from this hospital to Wuhan. The inclusion criteria were registered nurses who provided direct care to COVID-19 patients.

The questionnaire used covered 16 co-variables (depression, anxiety, and stress, along with 13 demographic variables). The variables that showed significant differences in the univariate analysis were entered into a model for the multivariate analysis. G*Power was used to estimate the sample size for this survey. A total of 128 cases were needed for the regression analysis (effect size = 0.25; $P = 0.05$; power = 0.95). Considering a sample turnover rate of 10%, the necessary sample size was determined to be at least 141 cases.

Instruments

The questionnaire consisted of a sociodemographic section, and it also incorporated the 10-item Connor-Davidson Resilience Scale (CD-RISC-10) and the simplified 21-item Depression Anxiety Stress Scale (DASS-21) (Lovibond and Lovibond, 1995).^{30,31} The sociodemographic variables covered 13 aspects: gender, age, educational level, marital status, offspring status, daily exercise duration, annual family income, work locality, practicing department, job title, worries about insufficient protective supplies, daily working hours, and daily workload.

The simplified version of the CD-RISC-10 was used to evaluate the subjects' ability to return to a normal state after encountering dilemmas or challenges.³⁰ This scale has demonstrated an excellent internal consistency during the evaluation of the Chinese

earthquake victims (Cronbach's alpha = 0.91); moreover, it demonstrated test-retest reliability (with an interval of 2 wk; $r = 0.90$).³² For this assessment, a 5-point Likert scale was used, wherein 0 means *not true at all*, 1 means *rarely true*, 2 means *sometimes true*, 3 means *often true*, and 4 means *true nearly all the time*. When the points for each of the items were summed up, the total score would range from 0 to 40 points. A higher total score denoted a higher level of resilience. In this study, the Cronbach's alpha of the CD-RISC-10 was 0.952.

This study also used the DASS-21 formulated by Lovibond and Lovibond.³¹ DASS-21 covered 3 dimensions, namely, depression, anxiety, and stress. Each dimension contained 7 items, which were used to evaluate the subjects' emotions over a period of 1 wk before filling out the questionnaire. For this assessment, a 4-point Likert scale was used, wherein 0 means *did not apply to me at all/never*, 1 means *applied to me to some degree or some of the time/sometimes*, 2 means *applied to me to a considerable degree or a large part of the time/often*, and 3 means *applied to me very much or most of the time/almost always*. For each scale, the total score is 0-21. A higher score denoted greater severity of negative emotions. The scores were used to classify depression, anxiety, and stress scales as normal, mild, moderate, severe, and extremely severe. This scale has demonstrated suitable psychometric properties in assessing nurses in Australia, with a Cronbach's alpha of 0.92, 0.86, and 0.89 for depression, anxiety, and stress scales, respectively.²⁵ In this study, the Cronbach's alpha for the overall DASS-21 was 0.961, and the values for the depression, anxiety, and stress scales were 0.927, 0.883, and 0.895, respectively.

Data Collection

A domestic online survey platform (<https://www.wjx.cn/>) was used by the participants to complete the questionnaire. Two trained researchers informed the subjects about the objectives and contents of this survey, and standardized forms and procedures were used to ensure consistency of data quality. The questionnaire was made available to the participants upon signing the informed consent forms. The returned questionnaires were double-checked, and the obtained data were entered into an analysis software by 2 other researchers. A total of 150 online questionnaires were distributed, and the response rate was 95.33%, the final recruitment number was 143.

Statistical Processing

Statistical analysis was performed using SPSS Statistics 22.0 (IBM, Armonk, NY). The Kolmogorov-Smirnov test, which was used to verify the normality of data, showed that resilience was normally distributed, although the DASS-21 scores were not. Numerical data were expressed as frequencies and percentages, and quantitative data were presented as means and standard deviations. Data with skewed distributions were described as medians and interquartile ranges. The independent 2-sample t-test and analysis of variance (ANOVA) were used to compare the differences in resilience between 2 or multiple groups. Spearman's correlation analysis was used to test the correlation of resilience with depression, anxiety, and stress. Stepwise multiple linear regression was subsequently used to identify the predictors of resilience. A P -value of < 0.05 was considered statistically significant.

Table 1. Demographic characteristics and the comparison of resilience among demographic characteristics of the frontline anti-epidemic nurses ($N=143$)

Variable	N	%
Sex		
Male	16	11.2%
Female	127	88.8%
Age group (y old)		
20-30	81	56.6%
31-40	53	37.1%
>40	9	6.3%
Education level		
Diploma	18	12.6%
Bachelor degree	108	75.5%
Master degree or higher	17	11.9%
Professional ranks and titles		
Junior title	84	58.7%
Intermediate title	48	33.6%
Senior title	11	7.7%
Marital status		
Single	62	43.4%
Married	81	56.6%
Exercise per day (hour)		
0	65	45.5%
<1	69	48.3%
1-2	9	6.3%
Which city you fight the epidemic		
Wuhan	56	39.2%
Changsha	87	60.8%
Working hours per day		
<5	35	24.5%
5-10	98	68.5%
>10	10	7.0%

Results

Demographic Data

Of the 143 responders, 127 were female (88.8%) and 16 were male (11.2%). A total of 56 (39.2%) frontline nurses from Changsha were dispatched to Wuhan, whereas 87 (60.8%) served in the Changsha Hospital. The average age of the participants was 30.62 ± 5.80 y (range: 22-52 y), and their average exercise duration was 1.62 ± 0.63 h/d; moreover, the average number of patients they cared for was 10.32 ± 8.09 per d, and their average working hours was 7.03 ± 2.59 h/d. More demographic details are presented in Table 1.

Resilience Level of the Frontline Anti-epidemic Nurses and Its Related Sociodemographic Factors

The mean resilience score was 28.45 ± 7.05 (range: 10-40). The univariate analysis showed that resilience was significantly influenced by gender ($t = 2.478$; $P = 0.014$), age ($F = 2.555$; $P = 0.042$), and daily exercise duration ($F = 4.030$; $P = 0.020$).

Levels of Depression, Anxiety, and Stress of the Frontline Anti-epidemic Nurses

The median scores (interquartile ranges) for depression, anxiety, and stress were 1 (0-5), 2 (1-6), and 3 (1-7), respectively.

Table 2. Association between resilience and depression, anxiety, stress of the frontline anti-epidemic nurses ($N=143$)

	Depression	Anxiety	Stress	Resilience
Depression	1			
Anxiety	0.774**	1		
Stress	0.829**	0.787**	1	
Resilience	-0.653**	-0.508**	-0.569**	1

** $P < 0.01$.

Table 3. Multiple linear regression coefficients among resilience, DASS-21, and demographics variables ($N=143$)

Variables	B	Beta	t	P	R	R ²
(Constant)	31.571				0.604	0.365
Depression	-1.094	-0.536	-7.821	0.000		
Female	-6.618	0.297	4.305	0.000		
Wuhan	-2.213	-0.154	-2.228	0.028		

Abbreviations: B, unstandardized coefficients; Beta, standardized coefficients; R², coefficient of determination.

Among the participants, 2.8% showed mild to severe depression levels and 11.2% showed mild to extremely severe anxiety levels. Only 0.7% experienced moderate stress levels.

Association of Resilience With the Depression, Anxiety, and Stress Levels of the Frontline Anti-epidemic Nurses

The correlation analysis (Table 2) showed that resilience was negatively correlated with the individual depression ($r = -0.653$; $P < 0.01$), anxiety ($r = -0.508$; $P < 0.01$), and stress scores ($r = -0.569$; $P < 0.01$). In other words, those nurses with higher depression, anxiety, and stress levels exhibited lower resilience.

Predictors of the Resilience of the Frontline Anti-epidemic Nurses

The multiple linear regression analysis showed that the female gender, being dispatched to Wuhan, and depression levels were the significant predictors of resilience ($P < 0.05$). These variables were shown to influence resilience significantly ($P < 0.05$) and accounted for 36.5% of the variance of resilience (Table 3). Frontline nurses who were female, dispatched to Wuhan, and exhibiting higher depression levels tended to have lower resilience levels.

Discussion

Resilience Levels of the Frontline Anti-epidemic Nurses

In this study, the frontline nurses' resilience score was 28.45 ± 7.05 , indicating a moderate resilience level. The frontline nurses' resilience score was higher than that of the Singaporean nurses (mean resilience score was 25.9) and Chinese nurses (mean resilience score was 23.6) during the nonoutbreak periods.^{20,33} This result could be explained by the fact that the majority of the frontline nurses were volunteers and that, even though they were facing enormous pressure, they still exhibited sufficient confidence and courage.³⁴ Nurses involved in global outbreaks, such as SARS, MERS, and Ebola, have experienced increased burnout, compassion fatigue, reduced job satisfaction, low morale, and work-related

stress.^{35–37} To better protect the frontline medical staff, the CPC Central Committee, which is the leading group on the prevention and control of the COVID-19 outbreak, released on February 22, 2020, a guideline for the implementation of measures to further protect and care for medical workers^{3,38}; these measures include instituting rational shifts and manpower management, ensuring sufficient supply of daily necessities, and increasing the frontline medical workers' compensations and benefits. The most important measure is the monitoring of the medical workers' psychological state and the provision of psychological havens for both the frontline medical workers and their families to help the latter concentrate on their frontline duties and to help improve their physical and mental wellbeing.^{3,39} For instance, counseling services in various forms (eg, telephone consultation, online/virtual consultation, and face-to-face consultation) had been carried out at different levels to help frontline medical workers deal with psychological problems.³⁸ COVID-19 has threaten the lives of mankind, and the main workforce involved in the fight against this pandemic are the medical workers, especially the frontline nurses all over the world. Long-term exposure to public health emergencies can lead to such conditions as depression and PTSD.^{40,41} Thus, administrators in all countries should realize the importance of establishing comprehensive support strategies to reduce the frontline nurses' anxiety, depression, and stress levels to maintain their physical and psychological wellbeing.

Influencing Factors of Resilience Among Frontline Anti-epidemic Nurses

Sociodemographic Factors

Our findings showed that younger nurses had a higher probability of having low resilience than the older nurses, consistent with the findings of another cross-sectional survey involving Singapore nurses.²⁰ This pattern was observed possibly because the older nurses in our study were more experienced, had completed more emergency drills, and had accumulated greater knowledge and skills, allowing them to accomplish their tasks smoothly and to handle emergencies with a greater degree of mental preparedness. By contrast, due to their lesser clinical nursing experiences and skills, younger nurses have experienced greater work and psychological stress and were more likely to exhibit adverse psychological responses; ultimately, they displayed lower resilience levels.

Daily exercise duration was another factor that was significantly related to the frontline nurses' resilience in this study. This finding is consistent with that of previous surveys,^{21,42} which showed that having a positive coping mechanism, such as exercising regularly, predicted a high level of resilience.

Although these 2 factors were not entered as predictors in the regression analysis, they still illustrated that administrators should continue focusing more on younger nurses as well as on the need to encourage nurses and to help them find diverse ways to adjust their physical and psychological status.⁴³

Our findings showed that female frontline nurses have a lower resilience than male frontline nurses. But this result was likely to be related to gender imbalance in the sample, male nurses' higher resilience could be explained that they were generally better at coping with stress and emotions than female nurses,⁴¹ or it was probably that the male nurses were more motivated as there were so few of them. It is imperative to encourage female nurses to communicate frequently with their family members and colleagues as social interactions reduce or divert negative emotions, such as anxiety

and stress, and they improve one's overall mood^{44,45}; moreover, the female nurses are advised to seek professional psychological counseling when necessary.

The resilience levels of the frontline nurses dispatched to Wuhan were significantly lower than those of their counterparts. Those dispatched to Wuhan during the COVID-19 crisis faced more pressure than usual, including a high risk of infection, insufficient personal protective equipment, heavy workloads and manpower shortages, confusion, discrimination, isolation, patients with negative emotions, separation from their families, and burnout.^{46,47} A systematic review presented that during an infectious disease outbreak, nurses heavily involved with direct patient care are more likely to report high stress levels and common mental disorders compared with other health-care professionals; moreover, nurses display the highest distress level.⁴⁸ Thus, nurses' psychological state should be closely monitored.

Psychological Factors

In this study, the levels of depression, anxiety, and stress were negatively correlated with resilience. In the multiple regression analysis, depression level was the predictor of resilience. This correlation could be attributed to the fact that frontline anti-epidemic nurses often work long hours under heavy rescue workloads. Also, their protective gear do not support good air circulation, causing a feeling of suffocation. Patient deaths and fear of being infected may also have contributed to high depression, anxiety, and stress levels. All these factors have negatively affected the nurses' resilience levels.⁴⁹

A good resilience can protect nurses even from turnover, PTSD, emotional exhaustion, and burnout. Moreover, it would improve patient satisfaction arising from the perceived better quality of care and better attitudes toward patients.²³ The study by Gartland et al. emphasized that an individual's resilience levels are never constant⁵⁰; thus, even after the pandemic, medical staff may still face some psychological problems,⁵¹ although these problems can be addressed with effective intervention measures. Therefore, constant attention is necessary to identify the influencing factors of resilience among frontline anti-epidemic nurses during the COVID-19 crisis and then adopt targeted intervention strategies to reduce their negative emotions and improve their experience. Interventions that promote frontline nurses' resilience are important not only in protecting the nurses themselves, but also in ensuring patients' safety and in preventing the spread of the epidemic.

Limitations

This study has several limitations. First, the survey recruited frontline nurses from 1 hospital, and the sample size was small. Therefore, it does not provide a complete picture of the resilience levels for all frontline anti-pandemic nurses. Second, the gender imbalance in the sample (male nurses are far fewer than female nurses) may affect the interpretation of the results. Third, we did not explore the correlation between resilience and nursing quality in fever clinics. Probably, frontline nurses with different levels of resilience will provide nursing care of varying qualities to their patients. Future studies may focus on the interventions that take into account the predictors reported herein to enhance nurses' resilience; moreover, future studies may follow up on nurses' mental health and psychological resilience.

Conclusions

This study conducted a survey to explore the sociodemographic and psychological predictors of resilience among the frontline nurses fighting the COVID-19 epidemic. The results suggested a moderate resilience level among the investigated nurses. Age, gender, work locality, and level of depression are the significant predictors of resilience. This finding suggests that nursing administrators should pay particular attention to young female nurses dispatched to epidemic hotspots, especially those exhibiting depression symptoms; moreover, administrators should take appropriate measures to boost nurses' resilience.

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Author contributions. Drs. Yan Zhang and Yang Xiong contributed equally to the article.

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